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Space and energy transitions in sub-Saharan Africa: Understated historical connections

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ABSTRACT

Sub-Saharan Africa is seeing an influx of international interest and investment in energy projects designed to address the energy poverty and climate agendas. Often missing from these energy initiatives is an acknowledgement that bringing about energy transitions will require more than just the creation of efficient energy markets and technological leapfrogging. This article explores how we may begin to add an historical dimension to the spatial analysis of contemporary energy systems in sub-Saharan Africa. Drawing on the seminal article by Bridge et al. (2013) on the spatial dimensions of energy transitions, on energy geographies literature and on various strands of social science research on Africa, the article examines the usefulness of a historical and spatial perspective to researching how energy systems in sub-Saharan Africa came to be the way they are today. This historical and spatial understanding of energy systems is necessary if we are to make sense of future energy transitions, yet the connections between past, present and future remain understated in current policy interventions.

1. Introduction

Sub-Saharan Africa is seeing an influx of international interest and investment in energy projects designed to address the energy poverty and climate agendas. A recent survey of fifty-eight initiatives covering various energy subsectors for Africa as a whole showed that investment had grown six-fold between 2003 and 2013, respectively from USD $750 million to over USD $4.7 billion [1]. About seventy-nine percent of this investment was directed at sub-Saharan Africa, but even that figure was well below the estimated USD $55 billion annual spend required to meet the target of universal access by 2030 [2]. Unsurprisingly, most initiatives focus on how to facilitate the creation of energy markets and attract private sector investment [1]. This approach mirrors attention to the fragmented governance landscape across Africa's energy sector [3–6]. There are particular concerns with the ability of national governments to address, simultaneously, a low-carbon agenda and the needs of the 625 million people who lack access to electricity in sub-Saharan Africa [7]. Despite the latest investments, the number of people without access seems to be rising – not decreasing – due to a combination of natural population growth, increase in energy exports, as well as an intensification in demand through urbanization [7]. This reinforces the argument of various authors who think that addressing sub-Saharan Africa's energy future will require a joint consideration of Africa's ongoing 'urban revolution' [8,9].

Often missing from these energy initiatives is an acknowledgement that bringing about energy transitions will require more than just the creation of efficient energy markets and technological leapfrogging [10]. While there are various ways of conceptualizing energy transitions (e.g. [11–13]), it is now recognized that change in energy systems requires transformations in various ecological and social dimensions that underpin social life, especially in urban areas [14–17]. It requires confronting the obduracy of energy infrastructure [18] and the path-dependencies historically embedded in them [19]. Path-dependencies have to be conceived in material terms and in relation to the various socio-technical arrangements that make up the broader energy system (e.g. technical expertise, resource extraction networks, regulations, finance, political and economic interests, or cultural practices). Finally, it requires addressing the spatial dimensions of energy systems in relation to the organization of social life; or, as Bridge et al. [20,331] put it, "developing new ways – and new geographies – of producing, living, and working with energy."

This article explores how we may begin to add an historical dimension to the spatial analysis of contemporary energy systems in sub-Saharan Africa. It examines the usefulness of an historical *and* spatial perspective to researching how energy systems in sub-Saharan Africa came to be the way they are today. This joint time-space understanding of energy systems is necessary if we are to make sense of future energy transitions [21,19], yet the connections between past, present and

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future remain understated in current policy interventions. To this purpose, the next section introduces a brief overview of most recent energy geographies literature and their arguments for a spatial perspective on energy systems. The section points to the importance of drawing out the historical dimension in spatial analyses of energy transitions in sub-Saharan Africa. Using the six spatial dimensions outlined by the seminal work of Bridge et al. [20], the following section explores how each dimension elicits specific investigations in the historical development of energy systems in sub-Saharan Africa. In particular, the section engages the energy geographies literature with other strands of social science literature on Africa. The article concludes with a reflection on how an historical and spatial perspective could improve future energy initiatives for sub-Saharan Africa.

2. Space, path-dependency and energy transitions in sub-Saharan Africa

The relationship between energy and the way we organize social life is inherently spatial and time-sensitive, yet spatial and historical dimensions remain largely understated in the aforementioned energy initiatives for sub-Saharan Africa. In their seminal article on geographies of energy transition, Bridge et al. [20,331] outline how a transition to a low-carbon energy system is "fundamentally a *geographical process* that involves reconfiguring spatial patterns of economic and social activity" (italics in the original). They highlight three reasons why this is the case. Firstly, energy systems are embedded in space. This is notably the case of its physical infrastructure, but other components are also spatially distributed and often unevenly so. For example, there is a spatial concentration of engineers and technical staff with the knowledge of designing, managing or maintaining an electric grid in urban areas as compared to rural areas. This affects the prospects of implementation of energy transitions. Secondly, the spatiality of energy systems produces uneven patterns of economic and social life [22,14]. Along similar lines, Huber [23,328] highlights that energy "underpins the basic aspects of social life – food, mobility, consumption, and the geographies of home and work." The differential availability of electricity, oil or charcoal to power these will significantly affect what kinds of economic activities (e.g. industry, services, farming) or social practices (e.g. using refrigerators, watching TV, powering mobile phones, building design standards) happen in different places. This has consequences not only for what kind of transition will take place, but also implies that different places will undergo different processes of transition over time. Finally, this unevenness can be found not just within one country, but also across countries (more on this spatial 'scale' below) [24]. As Bridge et al. [20] allude to, differential access to oil, alongside variable economic power to acquire it and offset environmental costs, had much to do with the ability of some countries in the global North to support their economic development since the 19th century and participate actively in (and shape) globalization (see also Ref. [25]). Some authors would argue that many countries in Sub-Saharan Africa have participated in this geopolitical order largely as sites for resource extraction [26,27]. This places the sub-continent in distinctive spatial and political economy relationships with regards to energy systems. Energy projects that fail to acknowledge how various locales have inserted themselves into that geopolitical order can fall short of understanding the key drivers (or obstacles) to desired processes of energy transitions in sub-Saharan Africa. As a result, Bridge et al. [20] suggest that we need to map out "changes in the spatial organisation of the energy system and economic activity more widely" [20,332]. The authors propose we pay attention to six spatial dimensions that can better elucidate energy transitions as a geographical process: location; landscape; territoriality; spatial differentiation and uneven development; scaling; and spatial embeddedness and path dependency.

Moreover, Bridge et al. [20] refer to various temporal dimensions through which these spatial dimensions can be examined, while highlighting that the future dimension has tended to dominate analyses of energy transitions. In this article, I would like to propose that a more explicit treatment of historical path-dependencies, technological lock-ins, and inertia is needed if we are to have a fuller understanding of contemporary energy systems in sub-Saharan Africa. Understood as a socio-technical system [28], an established energy system developed as a result of the coevolution of ecological, social, and technological systems over time and across space [14]. The choice of technology and design of an energy system is greatly influenced by initial conditions and events that lead to its adoption [15,29,21]. This would entail, for instance, issues around availability of fuels or production and distribution technology; contingent events leading to support for specific solutions (involving financiers, government policies, or others); and which individual costs individual users were willing to accept to participate in the system. Over time, as the system matured, it became reinforced by feedback loops that reinforced the connections between the system and other aspects of social life (e.g. distribution networks, the transport system, economic interests, governance apparatus). This is what is usually referred to as 'technological lock-in' [19]. The more intricate and complex the system, the greater its inertia to change [15]. As we shall see below, such path-dependencies and inertia can be observed in the spatial embeddedness of energy systems.

Interrogating the historical dimensions of (socio-technical) energy systems across sub-Saharan Africa is important because it foregrounds how Africans have not been *energy-less*, nor have they been *without* energy systems. While Africa (and especially sub-Saharan Africa) is usually deemed energy poor – conceptualized as having limited access to modern energy services such as electricity – Africans have satisfied their energy needs with other forms of energy (usually deemed 'traditional'), often mixing different fuels to 'power' their livelihoods. From an historical point of view, the study of such energy systems in the postcolonial moment cannot be disentangled from the diverse colonial experiences of different countries and even various locations within those countries. There are ongoing debates about the nature of the colonial enterprise led by different European powers [30,26,31], but these have seldom addressed the issue of energy broadly conceived. Conversely, current energy initiatives rarely take into account the colonial and postcolonial path-dependencies and historical contingencies of the energy systems they seek to transform [1]. This article makes an argument for the importance of examining more explicitly the historical and spatial dimensions of contemporary energy systems in sub-Saharan Africa. To do so, the next section takes each one of Bridge et al.'s six spatial dimensions in turn and teases out ways of examining the historical dimensions in the study of energy systems across sub-Saharan Africa.

3. Spatial and historical dimensions in the development of energy systems in sub-Saharan Africa

3.1. Location: context-specific energy patterns

The first spatial dimension identified by Bridge et al. [20] concerns *location*, conceived in both absolute and relational terms. This means specifying the kinds of energy produced, distributed and consumed in various locales and by whom; investigating how these energy patterns and networks have evolved over time and in relation to a locale's specific context; specifying how different locales relate to each other (or not), with particular attention to their role in the global economy; and exploring how such relational interactions affect the socio-technical dimensions of the energy system and the prospects of energy transitions.

Analyses of energy transitions must begin with a grounded knowledge of what energy systems exist in the very locales where they will unfold and, even more importantly, how they have come to be what they are today. Yet, detailed and accurate descriptions of how energy systems evolved historically in various sub-Saharan countries are few